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## Wildlife Tourism Malpractice Can Lead to Animal Poisoning with Plastics

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**KEY WORDS:** African Fish-Eagle, *Haliaeetus vocifer*; artificial feeding; microplastics; polystyrene; wildlife poisoning; wildlife tourism.

Wildlife tourism constitutes the leading source of foreign exchange in several countries and contributes significantly to rural employment (Damanian et al. 2019). Wildlife watching of free ranging animals is generally considered a low-impact activity compatible with conservation that has positive effects including financial revenues incentivizing species and habitat protection, facilitating environmental education, and providing wellness benefits to visitors through nature-based contact (Tablado and D’Amico 2017). Wildlife tourism also has negative effects such as disruption of animal activity, stress, accidental kill or injury, transmission of diseases, alterations in space use and breeding success, and wildlife habitat degradation (Green and Higginbottom 2001). These negative effects are accentuated when visitors and/or tour operators are unaware or intentionally ignore guidelines to protect wildlife.

Here I report a wildlife tourism practice based on artificial feeding that introduces a new potential risk for wildlife: animal poisoning with polystyrene. I observed it opportunistically while on holidays on 10 August 2022 at Lake Naivasha in Kenya, a popular birdwatching site included in the key tourism circuits in the country. Located in a high-altitude trough of the Rift Valley, it is one of the few freshwater lakes in eastern Africa declared a Ramsar Site for its ecological value (<https://rsis.ramsar.org/ris/724>). During a touristic boat trip on the lake, the guide advised tourists to prepare their cameras for a close encounter

with African Fish-Eagles (*Haliaeetus vocifer*), which were perched on trees along the lakeshore. The guide retrieved a fish he had on the boat and stuffed it with polystyrene, whistled, stood up while shaking the fish to get the attention of the eagles, and threw the fish into the water approximately 20 m away from the boat. An adult African Fish-Eagle flew toward the boat, picked up the fish, carried it to a tree, and ate it there (Fig. 1).

The use of polystyrene to make the fish float (because African Fish-Eagles only fish on the water’s surface) potentially involves several health-related risks for the eagles or other wildlife consuming it, and also constitutes a new source of environmental pollution (de Carvalho et al. 2021). The African Fish-Eagle I observed consumed the fish in a tree too far away for me to determine whether it ingested the polystyrene or dropped it during manipulation, but ingestion is likely, as numerous birds accidentally ingest plastics (Wang et al. 2021) including those feeding on fish such as seabirds (Wilcox et al. 2015) and Ospreys (*Pandion haliaetus*; Carlin et al. 2020). Polystyrene ingestion can cause serious health problems in birds in the form of physical impairment and toxicological effects (Wang et al. 2021). Physical damage can occur shortly after ingestion and includes injuries, suffocation, ulcers, gastrointestinal obstructions and perforations (Fry et al. 1987, Pierce et al. 2004, Wang et al. 2021). Toxicological effects can include delayed ovulation, impaired digestive and immune functions, inflammatory responses, and negative impacts on the circulatory system (Wang et al. 2021). Overall, plastic ingestion in birds can lead to starvation, reduced body weight, slower

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Figure 1. Touristic artificial feeding of African Fish-Eagle in Lake Naivasha. From left to right, (top): eagle perched on a lakeshore tree, guide stuffing fish with polystyrene, guide whistling and shaking the fish; (bottom): guide throwing fish to the water, eagle picking up the fish from the lake surface, eagle taking fish to the feeding perch.

growth rate, reduced reproductive output, and increased mortality (Pierce et al. 2004, Wang et al. 2021). Polystyrene dispersal in nature causes both primary and secondary contamination that may negatively affect a wide range of organisms, causing reduced survival of plankton, increased mortality among invertebrates, physiological and behavioral effects in fish, and respiratory effects in mammals (Kik et al. 2020). In addition, the dispersal of this nonbiodegradable plastic adds to the already concerning pollution problems of Lake Naivasha, which is currently impacted by organic waste, heavy metals, pesticides, and other contaminants from horticultural practices and other human activities (Otiang'a-Owiti and Oswe 2010).

The severity of pollutants' effects on individuals and the environment depends on the concentration and total exposure to the chemical. The anecdotal nature of this observation did not allow quantification of the extent of the problem, but this is likely not an isolated incident. The guide artificially fed the eagles with plastic-stuffed fish three times during a 1-hr boat trip; four other tourists I met who took a similar boat tour with different operators described the same pattern of artificial feeding, and although they could not confirm that the fish thrown contained plastic, they saw that it floated, so it likely contained

something to increase buoyancy. In addition, the fact that the eagles responded to the guide's whistle or to the floating fish—a habituation behavior that requires some training over time—suggests that artificial feeding of African Fish-Eagles in Lake Naivasha may be a widespread practice. Moreover, a similar plastic-fish baiting practice is described and denounced on a bird photography website: Grey-headed Fish-Eagles (*Ichthyophaga ichthyaetus*) in Singapore were baited with a live fish stuffed with pieces of polystyrene foam (<https://www.10000birds.com/unethical-photographers-bait-critically-endangered-eagles.htm>). This suggests that this practice may affect more species in other regions.

In addition to the polystyrene poisoning risk that I highlight here because it has not been reported in the scientific literature to my knowledge, the touristic practice observed is based on wildlife attraction through artificial feeding, which can alter natural behavior patterns and population numbers and can lead to dependency, habituation, the development of “begging” behaviors that eventually result in aggression toward humans, and intra- and inter-specific aggression due to the greater density of animals in a small area (Orams 2002, Knight 2009, Barrientos et al. 2020). The latter is particularly

concerning as Lake Naivasha hosts a high density of African Fish-Eagles and some individuals have killed others while defending their shoreline territories (Harper 2002, Virani and Chadge 2017).

Here I aim to draw attention to the need of further research to assess the effects of artificial feeding using polystyrene on African Fish-Eagles and the consequences of this pollution in Lake Naivasha. The intervention of local authorities may be needed to discourage polystyrene use and control inappropriate behavior of guides. Tourism education must be promoted both among visitors and tour operators, as the practice is grounded in the assumption that close-up encounters increase satisfaction, leading to more generous tips. Although this may be true for a majority of tourists, environmentally educated ones increasingly reject artificial practices (Tablado and D'Amico 2017). In this case, I found myself in a "tourist trap" in which I unintentionally contributed to this malpractice, as the tour operator advertised the experience as a boat tour in the lake where wildlife was abundant; thus, I assumed I would see the animals in a natural way, and there was no indication the tour included artificial feeding of the animals or the plastic involved. As a wildlife ecologist and a tourist, I expressed my discomfort with this practice, complained to the tour operator, and did my best to communicate the risk it involves for the birds. A growing body of research indicates that tourists' satisfaction can be achieved through skilled and knowledgeable guides, authenticity of the wildlife encounters, and practices that enlist visitors as conservation partners (Ballantyne et al. 2009, Egresi and Prakash 2019). Finally, the long-term sustainability of wildlife tourism requires that guides and tour operators guarantee animal welfare, preserving the resources on which their jobs and livelihoods depend (Tablado and D'Amico 2017).

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